

CLAIMS

The invention is claimed as follows:

1. A medical fluid system comprising:
 - a medical fluid flow path having a medical fluid supply, a first pump operable to pump medical fluid from the supply to an extracorporeal circuit and a second pump operable to pump fluid from a blood filtering device;
 - a branch located downstream from the first pump;
 - a first branch line communicating fluidly with: (i) the branch, (ii) a first clamping device operable to selectively allow and block flow through the first branch line and (iii) a first point in the extracorporeal circuit located upstream from the blood filtering device;
 - a second branch line communicating fluidly with: (i) the branch, (ii) a second clamping device operable to selectively allow and block flow through the second branch line and (iii) a second point in the extracorporeal circuit located downstream from the blood filtering device; and
 - a control scheme operable to selectively open at a given point in time at least one of the first and second clamping devices.
2. The medical fluid system of Claim 1, wherein at least two of the branch, the first clamping device and the second clamping device are packaged together.
3. The medical fluid system of Claim 1, which includes at least one of a first one-way flow device in the first branch line and a second one-way flow device in the second branch line.
4. The medical fluid system of Claim 3, wherein at least one of the first and second one-way flow devices is located, respectively, upstream from the first and second clamping devices.
5. The medical fluid system of Claim 1, wherein at least one of the first and second communication points includes an air separation device.

6. The medical fluid system of Claim 1, wherein the first point is located so that the medical fluid is fed into the extracorporeal circuit sufficiently upstream of the blood filtering device to perform a blood rinseback procedure.
7. The medical fluid system of Claim 1, wherein the medical fluid flow path includes a membrane filter operable to filter the medical fluid and an ultrafiltrate pump located downstream from a filtered particulate discharge outlet of the filter.
8. The medical fluid system of Claim 1, wherein the first and second clamping devices are controlled via an electronic or pneumatic signal.
9. The medical fluid system of Claim 1, wherein the control scheme is operable to open the first clamping device only for a first specified time period and thereafter open the second clamping device only for a second specified time period.
10. The medical fluid system of Claim 1, wherein the control scheme is operable to open the first clamping device for a first percentage of time and to open the second clamping device for a second percentage of the time.
11. The medical fluid system of Claim 1, wherein the control scheme is operable to open one of the first and second clamping devices only for a first specified time period and thereafter open both the first and second clamping devices for a second specified time period.
12. The medical fluid system of Claim 1, wherein the medical fluid is of an injectable quality solution.
13. The medical fluid system of Claim 1, wherein the first pump is stopped if the medical fluid is sensed to be outside of at least one of a preset conductivity range and a preset temperature range.

14. A medical fluid system comprising:
a medical fluid flow path having a medical fluid supply, a first pump operable to pump medical fluid from the supply to an extracorporeal circuit/blood filtering device and a second pump operable to pull fluid from the blood filtering device;
an apparatus operable to isolate the blood filtering device from the rest of the medical fluid flow path; and
a control scheme operable to selectively and concurrently command: (i) the isolating apparatus to isolate the blood filtering device and (ii) the first pump to deliver a volume of fluid to the extracorporeal circuit.
15. The medical fluid system of Claim 14, wherein the fluid volume is a bolus volume delivered during therapy to help prevent a patient from becoming hypotensive.
16. The medical fluid system of Claim 15, wherein the control scheme is operable to receive an operator input to commence delivery of the bolus volume.
17. The medical fluid system of Claim 15, wherein an amount of the bolus volume is entered by an operator when commencing delivery of the bolus volume.
18. The medical fluid system of Claim 15, wherein an amount of the bolus volume is predetermined prior to commencement of therapy.
19. The medical fluid system of Claim 15, wherein the control scheme is operable upon a biosensor input to commence delivery of the bolus volume.
20. The medical fluid system of Claim 19, wherein the biosensor is selected from the group consisting of a hematocrit sensor, a blood volume sensor, an electrolytic sensor, an oxygen sensor and any combination thereof.

21. The medical fluid system of Claim 14, wherein the fluid volume is a rinseback volume delivered at the end of therapy to rinse blood in the extracorporeal circuit back to a patient.
22. The medical fluid system of Claim 21, wherein the control scheme is operable to receive an operator input to commence delivery of the rinseback volume.
23. The medical fluid system of Claim 21, wherein the control scheme is operable to commence delivery of the rinseback volume automatically at the end of therapy.
24. The medical fluid system of Claim 21, wherein an amount of the rinseback volume is entered by an operator when commencing delivery of the rinseback volume.
25. The medical fluid system of Claim 21, wherein an amount of the rinseback volume is predetermined prior to commencement of therapy.
26. The medical fluid system of Claim 21, wherein the control scheme is operable to deliver the rinseback volume until a of threshold amount of blood is no longer sensed in the extracorporeal circuit.
27. The medical fluid system of Claim 14, wherein the fluid volume is a prime delivered at the beginning of the therapy to remove air from the extracorporeal circuit.
28. The medical fluid system of Claim 27, wherein the control scheme is operable to receive an operator input to commence delivery of the prime.
29. The medical fluid system of Claim 27, wherein the control scheme is operable to commence delivery of the prime automatically at the beginning of therapy.
30. The medical fluid system of Claim 27, wherein an amount of the prime is entered by an operator when commencing delivery of the prime.

31. The medical fluid system of Claim 27, wherein an amount of the prime is predetermined prior to commencement of therapy.

32. The medical fluid system of Claim 27, wherein the control scheme is operable to deliver the prime until air is no longer sensed in the extracorporeal circuit.

33. The medical fluid system of Claim 14, wherein the system is operable to perform hemodiafiltration and the isolating apparatus includes first and second valves placed upstream and downstream of the blood filtering device.

34. The medical fluid system of Claim 14, wherein the system is operable to perform hemofiltration and the isolating apparatus includes a valve placed downstream of the blood filtering device.

35. The medical fluid system of Claim 14, wherein the isolating apparatus includes a bypass valve operable to bypass fresh medical fluid around the blood filtering device in the medical fluid flow path.

36. The medical fluid system of Claim 14, wherein the medical fluid flow path is configured to selectively deliver medical fluid to the extracorporeal circuit upstream or downstream of the blood filtering device.

37. The medical fluid system of Claim 14, wherein the medical fluid flow path is configured to remove ultrafiltrate from the medical fluid flow path upstream from a point at which the medical fluid is delivered to the extracorporeal circuit.

38. The medical fluid system of Claim 14, wherein the control scheme is operable to stop the first pump if the medical fluid is sensed to be outside of at least one of a preset conductivity range and a preset temperature range.

39. A medical fluid system comprising:

a medical fluid flow path having a medical fluid supply, a first pump operable to pump medical fluid from the supply to an extracorporeal circuit/blood filtering device and a second pump operable to pull fluid from the blood filtering device; and

an ultrafiltrate pump configured and arranged to remove ultrafiltrate from the medical fluid flow path upstream from a point at which the medical fluid is delivered to the extracorporeal circuit and the blood filtering device.

40. The medical fluid system of Claim 39, wherein the pump is structured so that no fluid communication exists between a fluid inlet and a fluid outlet of the pump while pumping fluid in and out of the pump.

41. The medical fluid system of Claim 39, wherein the medical fluid flow path includes at least one membrane filtering device operable to filter fresh medical fluid before the fluid reaches the extracorporeal circuit/dialyzer, and wherein the ultrafiltrate pump is located downstream of a filtered particulate outlet port of the membrane filtering device.

42. The medical fluid system of Claim 39, wherein the medical fluid flow path includes at least one membrane filtering device operable to filter fresh medical fluid before the fluid reaches the extracorporeal circuit/dialyzer, and wherein the ultrafiltrate pump is positioned to rinse at least some of the particulate from the filtering device.

43. The medical fluid system of Claim 39, wherein the medical fluid flow path includes at least one membrane filtering device operable to filter fresh medical fluid before the fluid reaches the extracorporeal circuit/dialyzer, and wherein the ultrafiltrate pump is positioned to purge at least some of the air trapped in the filtering device.

44. The medical fluid system of Claim 39, wherein the medical fluid flow path is configured to selectively deliver medical fluid to the extracorporeal circuit upstream or downstream of the blood filtering device.

45. The medical fluid system of Claim 39, which includes an isolating apparatus operable to isolate the blood filtering device from the rest of the medical flow path so that a positive net volume of medical fluid can be delivered to the patient.

46. A medical fluid system comprising:
a medical fluid flow path in communication with, in order:
a medical fluid supply;
a first pump;
a first filter;
a second filter;
a third filter; and
a second pump, the first pump operable to pump medical fluid through the filters and the second pump operable to pump fluid from the third filter into an extracorporeal circuit, the extracorporeal circuit including a blood filtering device.

47. The medical fluid system of Claim 46, wherein at least one of the first, second and third filters is a microfilter.

48. The medical fluid system of Claim 46, wherein at least one of the first, second and third filters is an ultrafilter.

49. The medical fluid system of Claim 46, wherein the flow path is in communication with at least one flow component, the flow component located between at least one pair of the first, second and third filters.

50. The medical fluid system of Claim 46, wherein the filters are located in series.

51. The medical fluid system of Claim 46, which includes a third pump in fluid communication with the blood filtering device, the third pump volumetrically matched with the first pump so that a substantially identical volume of fluid entering the extracorporeal circuit is removed by the third pump through the blood filtering device.

52. The medical fluid system of Claim 46, wherein the medical fluid is an electrolyte fluid.

53. The medical fluid system of Claim 46, wherein the medical fluid flow path is configured to selectively deliver medical fluid to the extracorporeal circuit upstream or downstream of the blood filtering device.

54. The medical fluid system of Claim 46, wherein the medical fluid flow path is configured to remove ultrafiltrate from the medical fluid flow path upstream from a point at which the medical fluid is delivered to the extracorporeal circuit.

55. The medical fluid system of Claim 46, wherein the first pump is stopped if the medical fluid is sensed to be outside of at least one of a preset conductivity range and a preset temperature range.

56. A medical fluid method comprising the steps of:
using a postdilution clearance mode throughout at least two thirds of a blood therapy treatment for a patient as a primary vehicle for blood clearance; and
using a predilution clearance mode throughout less than one-third of the blood therapy treatment to help prevent hemoconcentration of the blood of the patient.

57. The medical fluid method of Claim 56, which includes configuring the predilution and postdilution clearance modes to occur at different times during the therapy treatment.

58. The medical fluid method of Claim 56, which includes configuring at least a portion of the predilution and postdilution clearance modes to occur simultaneously within the therapy treatment.

59. The medical fluid method of Claim 56, which includes directing medical fluid pumped from a substitution pump to perform either predilution clearance or postdilution clearance.

60. The medical fluid method of Claim 56, which occurs at a first time and which further includes enabling medical fluid pumped by the substitution pump to perform both predilution and postdilution clearance at a second time within the therapy treatment.

61. The medical fluid method of Claim 56, which includes the step of delivering a blood rinseback volume of medical fluid.

62. The medical fluid method of Claim 56, which includes the step of delivering a bolus of medical fluid during the therapy treatment.

63. The medical fluid method of Claim 56, which includes removing ultrafiltrate from the patient during at least one of the predilution and postdilution clearance modes used in the blood therapy treatment.

64. The medical fluid method of Claim 63, which includes removing ultrafiltrate upstream from a point at which the medical fluid is delivered to the patient's extracorporeal circuit in one of the predilution or postdilution modes.

65. The medical fluid method of Claim 56, which includes infusing medical fluid additionally into a blood filtering device during at least one of the predilution and postdilution clearance modes used in the blood therapy treatment.

66. The medical fluid method of Claim 56, which includes the step of discontinuing medical fluid flow if the medical fluid is sensed to be outside at least one of a conductivity range and a temperature range.

67. A medical fluid method comprising the steps of:
infusing medical fluid into an extracorporeal circuit/blood filtering device;
removing fluid from the blood filtering device such that a net volume of liquid is removed from a patient;
isolating the blood filtering device from a pump operable to remove the fluid from the blood filtering device; and
delivering a volume of fresh medical fluid to the patient.
68. The medical fluid method of Claim 67, wherein isolating the blood filtering device from the pump is a first portion of the isolation step, and wherein the isolating step further includes bypassing the medical fluid so that the fluid does not enter the blood filtering device.
69. The medical fluid method of Claim 67, which includes the step of resuming the infusion and removing steps after the volume has been delivered.
70. The medical fluid method of Claim 67, which includes delivering the volume of fresh medical fluid to the patient at the end of therapy to rinse blood back to the patient.
71. The medical fluid method of Claim 67, which includes enabling the volume amount to be selected proximate to the time of delivery.
72. The medical fluid method of Claim 67, which includes enabling the volume amount to be preselected.
73. The medical fluid method of Claim 67, which includes enabling the volume amount to be controlled automatically by delivering the volume until receiving an input from a sensor.

74. The medical fluid method of Claim 67, wherein the infusing and removing steps include selectively performing predilution infusion, postdilution infusion or both simultaneously.

75. The medical fluid method of Claim 67, which includes removing ultrafiltrate upstream from a point at which the medical fluid is delivered to the extracorporeal circuit/blood filtering device during at least one of the infusion and removing steps.

76. The medical fluid method of Claim 67, which includes the step of discontinuing medical fluid flow if the medical fluid is sensed to be outside at least one of a conductivity range and a temperature range.

77. The medical fluid method of Claim 67, which includes delivering the volume automatically upon receipt of an input from a biosensor, the biosensor selected from the group consisting of a hematocrit sensor, a blood volume sensor, an electrolytic sensor, an oxygen sensor and any combination thereof.

78. A medical fluid method comprising the steps of:
infusing from a supply a first amount of fresh medical fluid into an extracorporeal circuit/blood filtering device;
removing a second amount of fluid from the blood filtering device; and
removing a third amount of fresh medical fluid from the supply so that the third amount is not delivered with the first amount to the extracorporeal circuit/blood filtering device, wherein the second amount is substantially equal to the first amount plus the third amount.

79. The medical fluid method of Claim 78, which includes removing the third amount downstream from at least one medical fluid membrane filtering device.

80. The medical fluid method of Claim 78, which includes removing the third amount via an ultrafiltrate pump operable to isolate a fluid inlet of the pump and a fluid outlet of the ultrafiltrate pump during a pump-in/pump-out stroke.

81. The medical fluid method of Claim 78, which includes removing the third amount of fluid via a pump operable to expose the fresh medical fluid to air.

82. The medical fluid method of Claim 78, which includes using the third amount of fluid to rinse particulates from at least one reusable medical fluid filter.

83. The medical fluid method of Claim 78, which includes using the third amount of fluid to purge air from at least one reusable medical fluid filter.

84. The medical fluid method of Claim 78, which includes the step of monitoring the removing of the third amount so that the third amount can be controlled to match a patient's prescribed ultrafiltrate removal amount.

85. The medical fluid method of Claim 78, wherein infusing the first amount includes selectively performing predilution infusion, postdilution infusion or both simultaneously.

86. The medical fluid method of Claim 78, which includes the further step of delivering a blood rinseback volume of medical fluid to the extracorporeal circuit.

87. The medical fluid method of Claim 78, which includes the step of delivering a bolus of medical fluid to the extracorporeal circuit during the therapy treatment.

88. The medical fluid method of Claim 78, which includes the step of recirculating at least a portion of the third amount to be infused with the supply fluid.

89. The medical fluid method of Claim 88, which includes the step of removing air from the recirculated portion before the portion is combined with the supply fluid.

90. The medical fluid method of Claim 78, which includes the step of discontinuing medical fluid flow if the medical fluid is sensed to be outside at least one of a conductivity range and a temperature range.

91. A medical fluid method comprising:

configuring a flow path to enable a first pump to pump medical fluid in order through a first filter, a second filter, a third filter, the filters operable to remove endotoxin from the medical fluid supply; and

operating a second pump to pump fluid from the third filter into an extracorporeal circuit.

92. The medical fluid method of Claim 91, which includes filtering bacteria from the medical supply.

93. The medical fluid method of Claim 91, which includes configuring the extracorporeal circuit to selectively perform predilution infusion, postdilution infusion or both simultaneously.

94. The medical fluid method of Claim 91, which includes removing ultrafiltrate upstream from a point at which the medical fluid is delivered to the extracorporeal circuit.

95. The medical fluid method of Claim 91, which includes the step of discontinuing medical fluid flow if the medical fluid is sensed to be outside at least one of a conductivity range and a temperature range.

96. A medical fluid method comprising the steps of:

configuring a medical fluid therapy flow path to have at least one filter placed between an upstream first pump and a downstream second pump and operating the first pump to pump at a higher flow rate than the second pump to help prevent stagnant fluid areas within the filter.

97. The medical fluid method of Claim 96, which includes configuring the filter to be a reusable filter.

98. The medical fluid method of Claim 96, which includes delivering filtered medical fluid to an extracorporeal circuit.